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Development of the MQ-9 Reaper Fuselage Container CNU-697/E

403 SCMS/GUEB
AIR FORCE PACKAGING TECHNOLOGY & ENGINEERING FACILITY
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20 May 2008

NOTICE

AFPTEF PROJECT NO. 06-P-103
TITLE: Development of the MQ-9 Reaper Fuselage Container

ABSTRACT

The Air Force Packaging Technology & Engineering Facility (AFPTEF) was tasked with the design of a new shipping and storage container for the MQ-9 Reaper fuselage in March of 2006. The previous container did not adequately satisfy user needs and Air Force requirements. A main problem was that it was designed for an MQ-9 Reaper fuselage, wings, and tails combined, which exceeded the 10,000 lb Air Force requirement for available ground support equipment. AFPTEF designed a smaller container for only the fuselage and a separate container for the wings and tails in order to bring container weights down under the 10,000 lb upper limit. Both containers feature retractable casters for rapid C-130 deployment and easier handling. The fuselage container features a wire rope isolator mounted cradle system to protect the fuselage (20G fragility), ballast storage areas, and shadow box storage areas for assorted small parts.
The new container, CNU-697/E, designed with SAE ARP1967A, is an aluminum, long-life, controlled breathing, reusable shipping and storage container. CNU-697/E protects the MQ-9 Reaper fuselage mechanically and environmentally and has passed all qualification tests per ASTM D4169.

Total man-hours: 3200

PROJECT ENGINEER:

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INTRODUCTION

BACKGROUND – The MQ-9 Reaper fuselage, wings, and tails were shipped and stored in a single fiberglass container that required a forklift with greater than 10k rated capacity. This was a main problem due to limited availability of ground support equipment (GSE) at some operating locations. The Air Force requirement was that the MQ-9 Reaper containers be able to be handled by a forklift with a common 10k rated lift capacity. This prompted the MQ-9 Reaper program office and AFPTEF to develop a new family of containers for storage and transportation of the MQ-9 Reaper fuselage, wings and tails, propeller, and QEC engine. In addition to meeting weight requirements, it was an opportunity to expand and enhance the capabilities and functionality of the containers to better facilitate the Air Force users.

REQUIREMENTS – AFPTEF and the MQ-9 Reaper program office at Wright-Patterson AFB and General Atomics agreed upon a list of requirements. The requirements are as follows:

- Sealed/controlled-breathing container that protects against varied environmental conditions and weather during either inside or outside shipping and storage
- Aluminum construction
- Weight under 10,000 lb
- Fuselage shock/vibration limited to 20 Gs
- Retractable caster system
- Transportable on current C-130 aircraft
- External document storage
- Accommodate one fuselage, 150 lb extra ballast weight, and assorted small parts
- Reusable and designed for long life (20 years)
- Low maintenance
- Field repairable hardware
- Forklift capabilities

DEVELOPMENT

DESIGN – The MQ-9 Reaper fuselage shipping and storage container (CNU-697/E) design (Appendix 2, Figures 1, 3, & 4) meets all the users' requirements. The CNU-697/E is a sealed, welded aluminum, controlled breathing, reusable container. The container is engineered for the physical and environmental protection of the fuselage during worldwide transportation and storage. The container consists of a base (Appendix 2, Figure 3), fuselage cradle mounting system, and completely removable cover (Appendix 2, Figure 4) equipped with the special features listed below.
The base is a one piece skid/double walled base extrusion with forklift openings, humidity indicator, pressure equalizing valve (1.0 psi pressure/ 1.0 psi vacuum), document receptacle, and desiccant port for easy replacement of desiccant (controls dehumidification). The extrusions that make up the base of this container and the ones integrated into the cover are new designs that maintain the usability and functionality of

standard designs but are stiffer in all directions. A silicone rubber gasket and quick release cam-over-center latches create a water/air-tight seal at the base-cover interface. The cover is removable with built in and fully enclosed forklift pockets. During cover removal, four corner guide posts keep the cover away from the fuselage. These fold down to facilitate fuselage loading/unloading.

The cradle is designed to support the fuselage at bulkhead locations. The cradle is suspended in the base by 12 stainless steel wire rope coil isolators that protect the fuselage, keeping the response from shock and vibration below the 20G fragility requirement. A foam lined saddle that is shaped to exactly fit the underside of the fuselage cross section at each of the eight interface locations (between the cradle and the fuselage) provides support. Six ratchet cargo straps fasten the fuselage to the cradle. There is also an additional strap mount system that pins into the aircraft tie down lugs for additional vertical restraint (Appendix 2, Figure 13).

Inside the center of the base on the right and left sides, an area for ballast storage has been provided where up to 150 lbs of ballast plates can be stowed (Appendix 2, Figure 14). There are fully enclosed shadow boxes inside the base at the extreme fwd (Appendix 2, Figure 15) and aft (Appendix 2, Figure 16) locations to contain assorted small parts.

For rapid C-130 deployment capability, a retractable caster system was developed so that the container could roll onto a C-130 then, subsequently, since the container is narrow enough for a walkway along the side, the casters could be retracted to either set the container on blocks or lower the container directly onto the floor of the aircraft. This system was designed to operate under the full load of the container weight without any external lifting device. (Appendix 2, Figures 9 & 10)

Container external dimensions are 430.0 inches length, 59.0 inches width, and 76.8 inches height (88.8 inches with casters lowered). Container empty weight is 5600 pounds and 9300 pounds with the fuselage, ballast, and other parts in place.

MQ-9 REAPER FUSELAGE CONTAINER FEATURES	
Pressure Equalizing Valve	4
Humidity Indicator	1
Desiccant Port	1
Document Receptacle	1
Forkliftable	Yes
Cover Latches	58
Cover Lift Handles	None
Cover Lift Rings	None
Cover Tether Rings	None
Base Lift Handles	None
Base Tie-down Rings	20
Stacking Capability	No

PROTOTYPE – AFPTEF fabricated one CNU-697/E prototype container in house for testing. The prototype container was fabricated in accordance with (IAW) all requirements and tolerances of the container drawing package. The drawing package

used for prototype fabrication has been released for the manufacture of production quantities of the container. Each face of the container was uniquely identified for testing identification as shown below.

DESIGNATED SIDE	CONTAINER FEATURE
Top	Cover Top
Aft	Desiccant Port
Right	Right Side from Aft
Left	Left Side from Aft
Forward	Opposite Aft
Bottom	Base Bottom

QUALIFICATION TESTING

TEST LOAD – The test load was a five section, bolted together fuselage mass simulator (Appendix 2, Figures 2, 3, & 4), designed by General Atomics and fabricated by AFPTEF. It was constructed with a center pipe that intersected steel plates. Each plate was shaped to match the fuselage cross sectional shape at various bulkhead positions to be supported by the container cradle saddles. The mass simulator closely matched the fuselage length, weight, center of gravity, and stiffness. The test load weight was 3400 pounds.

TEST PLAN – The test plan primary references were ASTM D 4169 and SAE ARP 1967 (Appendix 1). The test methods specified in this test plan constituted the procedure for performing the tests on the container. The performance criteria for evaluation of container acceptability were specified at 20 Gs maximum and an initial and final leak rate of 0.05 psi per hour at 1.0 psi. These tests are commonly applied to special shipping containers providing rough handling protection to sensitive items. The tests were performed at AFPTEF, Building 91, Area C, Wright-Patterson AFB.

ITEM INSTRUMENTATION – The test load was instrumented with a piezoelectric triaxial accelerometer mounted as close to the center of gravity as possible on a vertical face of a mass simulator steel plate, approximately 2 inches above the pipe (Appendix 2, Figure 5). The accelerometer was used to record actual accelerations sustained by the test mass. Primary accelerometer axis orientations were as follows:

X Axis - Directed through container Left and Right sides.
Y Axis - Directed through container Top and Bottom sides (vertical motion).
Z Axis - Directed through container Forward and Aft (desiccant port) sides.

See Appendix 4 for detailed accelerometer and other instrumentation information.

TEST SEQUENCES – Note: All test sequences were performed at ambient temperature and humidity, unless otherwise noted in the test procedure.

TEST SEQUENCE 1 – Leak Test

Procedure – The desiccant port cover was removed and replaced with a port cover modified for attachment of the digital manometer and vacuum/pressure pump lines. The container was closed and sealed. The leak test was conducted at ambient temperature and pressure. The pneumatic pressure leak technique was used to pressurize the container to a minimum test pressure of 1.0 psi. Maximum allowable leak rate is 0.05 psi per hour. (Appendix 2, Figure 6).

Results – The container passed the leak test with a leak rate less than the maximum allowed rate of 0.05 psi per hour.

TEST SEQUENCE 2 – Vacuum Retention Test

Procedure – The desiccant port cover was removed and replaced with a port cover modified for attachment of the digital manometer and vacuum/pressure pump lines. The container was closed and sealed. The vacuum retention test was conducted at ambient temperature and pressure. The air inside the container was evacuated to a minimum vacuum of -1.0 psi. Maximum allowable pressure increase rate is 0.05 psi per hour. (see Appendix 2, Figure 6).

Results – The container passed the vacuum retention test with a pressure increase rate less than the maximum allowed rate of 0.05 psi per hour.

TEST SEQUENCE 3 – Rotational Drops

Procedure – A drop height of 12 inches was used to perform four corner and four edge drops onto a smooth concrete surface, and the impact levels were recorded. The maximum allowed impact level for the item was 20 Gs. (Appendix 2, Figures 7 & 8)

Results – All of the recorded impact peak G data (filtered) was less than the maximum allowed 20 Gs. The open and hollow structure of the test mass caused excessive noise (ringing) upon each impact, which was picked up by the accelerometer and severely obscured the impact waveform. Therefore, all waveform data was filtered at frequencies ranging from 70 Hz to 80 Hz as appropriate for that waveform. The filter frequencies for these complex shock pulses were conservatively calculated as 10 times the base frequency of the shock pulse. There was no damage to either the container or the test mass. The container met the test requirements. (Appendix 3, Table 1 and Waveforms.)

TEST SEQUENCE 4 – Leak Test

Procedure – Test Sequence 1 was not repeated as stated in the test plan. During Test Sequence 3, welds on the tie down ring mounts failed as a result of a fabrication error. The ring mount welds were not completed in accordance with the drawing package. The weld failure caused the ring mounts to bend and crack the container wall, which caused leaks.

Results – N/A

TEST CONCLUSIONS – No damage occurred during the above testing to the container, isolation system or test item. All impact levels are at or below the item fragility limit of 20 Gs. Therefore, the container and mounting system do provide adequate protection for the fuselage.

FIT & FUNCTION TESTING

Fit and function testing for the fuselage/cradle was completed on site at General Atomics' facility in San Diego, CA. A production fuselage was loaded onto the container cradle and checked for fit (Appendix 2, Figure 11 & 12). Fit and function was further verified using the mass simulator.
In addition, a C-130 loading test was performed on site at Wright-Patterson AFB, and consisted of loading the container, with mass simulator in place, into an actual C-130 with a typical interior configuration. The loaded container was rolled up the aircraft ramp and onto the aircraft by winching. After successful loading, the retractable caster system was used to lower the container onto blocking and bracing. It was then unloaded in reverse order. (Appendix 2, Figures 9 & 10)

CONCLUSIONS

No damage occurred as a direct result of the above testing to the container, mounting system or test mass. The only damage to the container occurred as a result of lifting the container for drop testing on improperly welded tie down ring mounts; this damage would not have occurred if the mounts were properly welded. There was no evidence of any contact or impact between the test mass and the container walls or lid. All impact levels are below the item fragility limit of 20 G's. The CNU-697/E aluminum container was accepted by the Predator Program Office at Wright-Patterson AFB. The container met all the user's requirements. The container can protect an MQ-9 Reaper fuselage during world-wide transportation and storage and will likely save the Air Force tens of thousands of dollars in O&M costs.

RECOMMENDATIONS

AFPTEF recommends that new containers be procured immediately and delivered to avoid damage to MQ-9 Reaper fuselages currently in the logistics cycle, thus mitigating overall shipping risks. All fiberglass containers for the MQ-9 Reaper should be replaced. New containers should be procured as needed.

APPENDIX 1: Test Plan

AF PACKAGING TECHNOLOGY AND ENGINEERING FACILITY (Container Test Plan)					**AFPTEF PROJECT NUMBER:** 06-P-103	
CONTAINER SIZE (L x W x D) (IN) **INTERIOR:**	**EXTERIOR:**	**WEIGHT (LB)** **GROSS:**	**ITEM:**	**CUBE (CU. FT)**	**QUANTITY:**	**DATE:**
425 X 54 X 72.5	430 X 59 X 76.8	9300	3400	1127.6	1	8 Aug 07
ITEM NAME: MQ-9 Reaper Fuselage Container				**MANUFACTURER:**		
CONTAINER NAME: Reusable Shipping & Storage Container					**CONTAINER COST:**	
PACK DESCRIPTION: Extruded Aluminum Cntr., Aluminum Cradle, Test Load of a Reaper Fuselage w/ cg Lifting Fixture						
CONDITIONING: As noted below						

TEST NO.	**REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S**	**TEST TITLE AND PARAMETERS**	**CONTAINER ORIENTATION**	**INSTRU-MENTATION**
		NOTE No damage to contents is acceptable and Package must be in serviceable condition. Serviceable means remains sealed, with no deformities, etc.		
		Quality Conformance Tests		
1.		**Examination of Product.**		
	SAE ARP 1967 Par. 4.5.1 Table I	Container shall be carefully examined to determine conformance with material, workmanship, and requirements as specified in Table and drawings.	Ambient temp.	Visual Inspection (VI)
2.		**Weight Test.**		
	SAE ARP 1967 Par. 4.5.8.3.7	The empty container shall be weighed.	Ambient temp.	Scale

COMMENTS:

PREPARED BY:	**APPROVED BY:**
Matthew P. Bozzuto, Mechanical Engineer	Robbin L. Miller, Chief AFPTEF

AF PACKAGING TECHNOLOGY AND ENGINEERING FACILITY (Container Test Plan)					**AFPTEF PROJECT NUMBER:** 06-P-103	
CONTAINER SIZE (L x W x D) (IN) **INTERIOR:**	**EXTERIOR:**	**WEIGHT (LB)** **GROSS:**	**ITEM:**	**CUBE (CU. FT)**	**QUANTITY:**	**DATE:**
425 X 54 X 72.5	430 X 59 X 76.8	9300	3400	1127.6	1	8 Aug 07
ITEM NAME: MQ-9 Reaper Fuselage Container				**MANUFACTURER:**		
CONTAINER NAME: Reusable Shipping & Storage Container					**CONTAINER COST:**	
PACK DESCRIPTION: Extruded Aluminum Cntr., Aluminum Cradle, Test Load of a Reaper Fuselage w/ cg Lifting Fixture						
CONDITIONING: As noted below						

TEST NO.	**REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S**	**TEST TITLE AND PARAMETERS**	**CONTAINER ORIENTATION**	**INSTRU-MENTATION**
		Performance Tests		
3.	**Leak Test.**			
	SAE ARP 1967 Par. 4.5.2.1	Pneumatic pressure at 1.0 psi and vacuum retention at 1.0 psi. After temperature stabilization, pressure drop shall not exceed 0.05 psi per hour. Perform leak test again at end of test series.	Ambient temp.	Pressure Transducer (PT)
4.	**Rotational Drop Tests (Ambient Temperature).**			
	SAE ARP 1967A Par. 4.5.3 ASTM D 4169 ASTM D 6179 Methods A&B	Drop height shall be 12". Item shall not sustain more than 20 Gs.	Ambient temp. One drop on all bottom corners (4 drops) and one drop on all edges (4 drops).	VI Tri-axial Accelerometer

COMMENTS:

PREPARED BY:	**APPROVED BY:**
Matthew P. Bozzuto, Mechanical Engineer	Robbin L. Miller, Chief AFPTEF

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APPENDIX 2: Fabrication & Testing Photographs

Figure 1. Closed container with casters extended.

Figure 2. Mass simulator.

Figure 3. Mass simulator next to container cradle & base.

Figure 4. Mass simulator in container with cover, casters retracted.

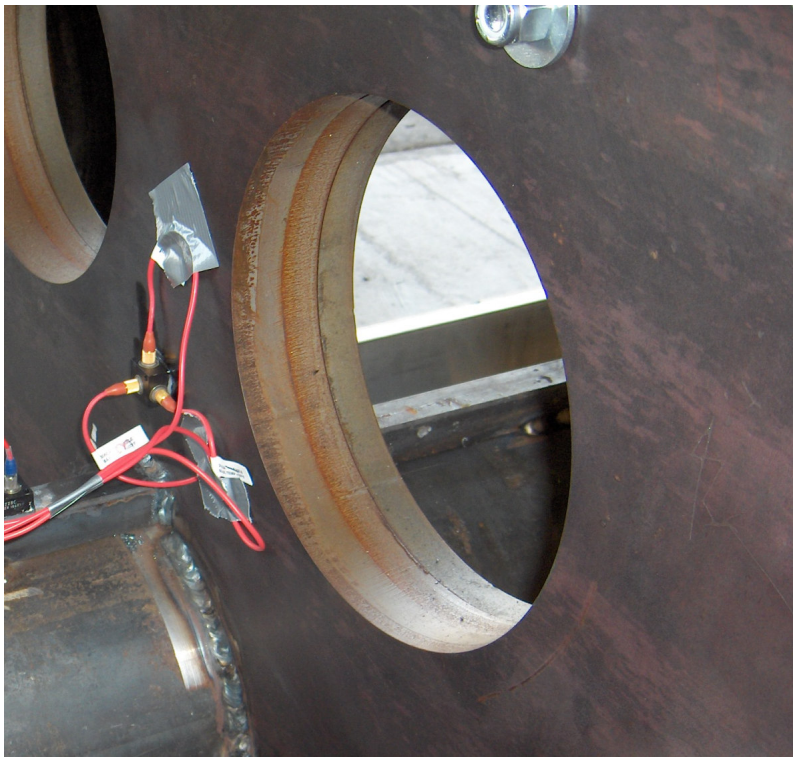


Figure 5. Placement of primary accelerometer on vertical face of mass simulator plate near center of gravity.

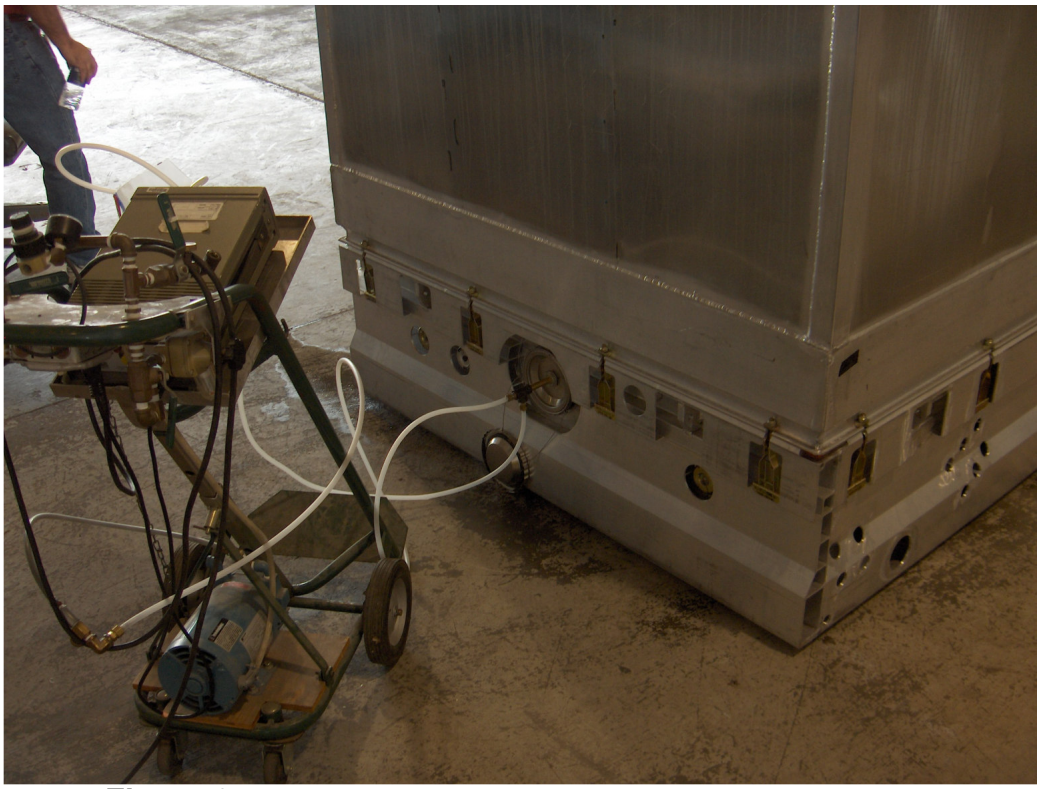


Figure 6. Pressure Test Set-up (for both pressure and vacuum).

Figure 7. Rotational Corner Drop.

Figure 8. Rotational Edge Drop.

Figure 9. Container being winched up the C-130 ramp.

Figure 10. Container loaded on the C-130.

Figure 11. Fuselage/cradle fit and function testing.

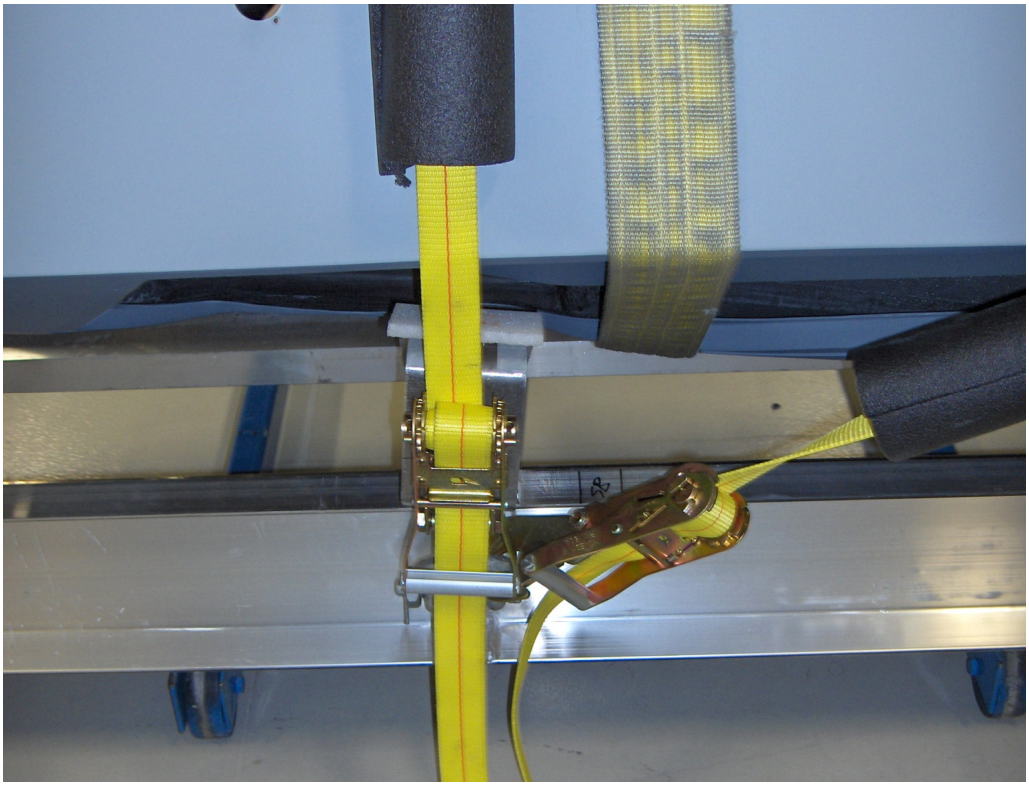


Figure 12. Tie down strap.

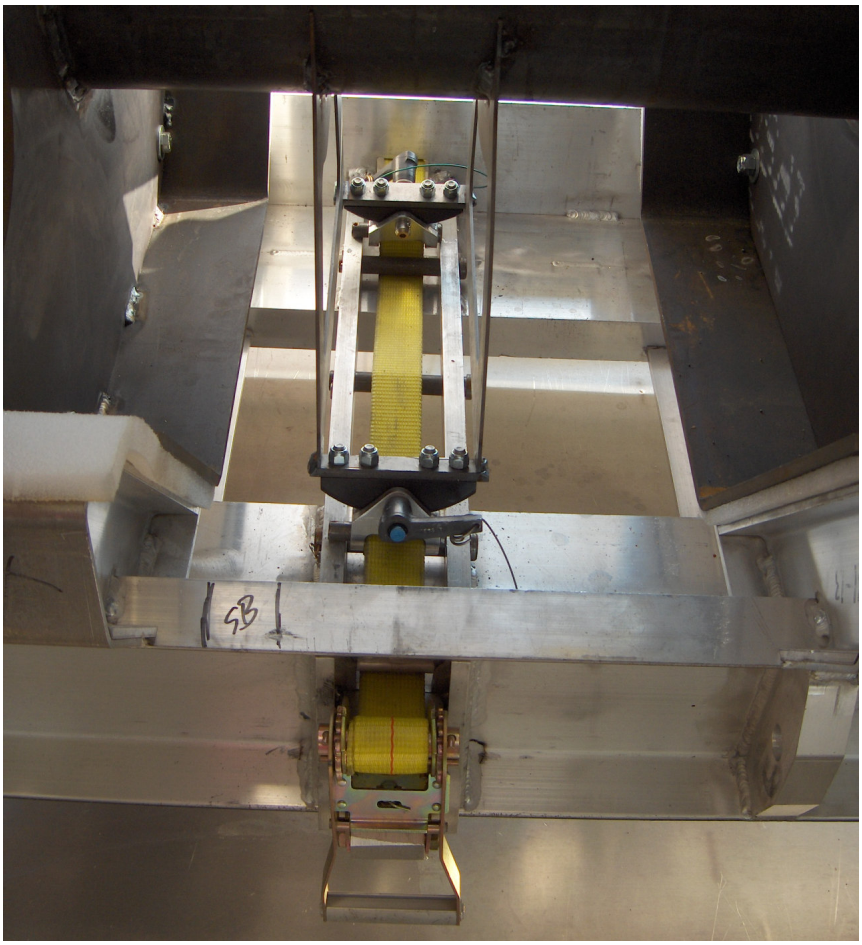


Figure 13. Center tie down interface with aircraft tie down lugs, shown here on the mass simulator.

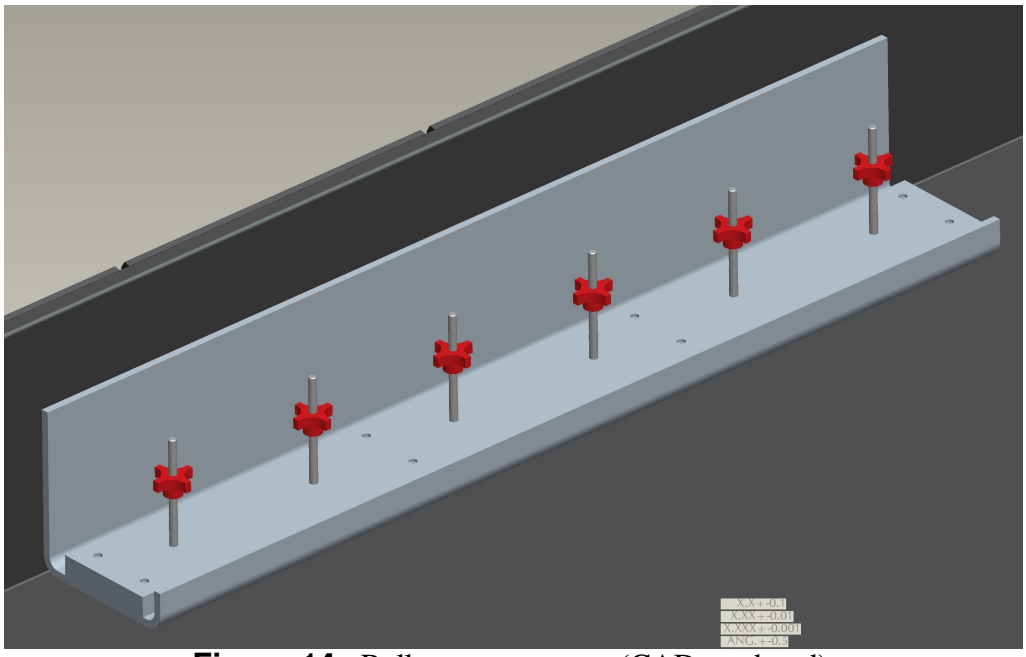


Figure 14. Ballast storage area (CAD rendered).

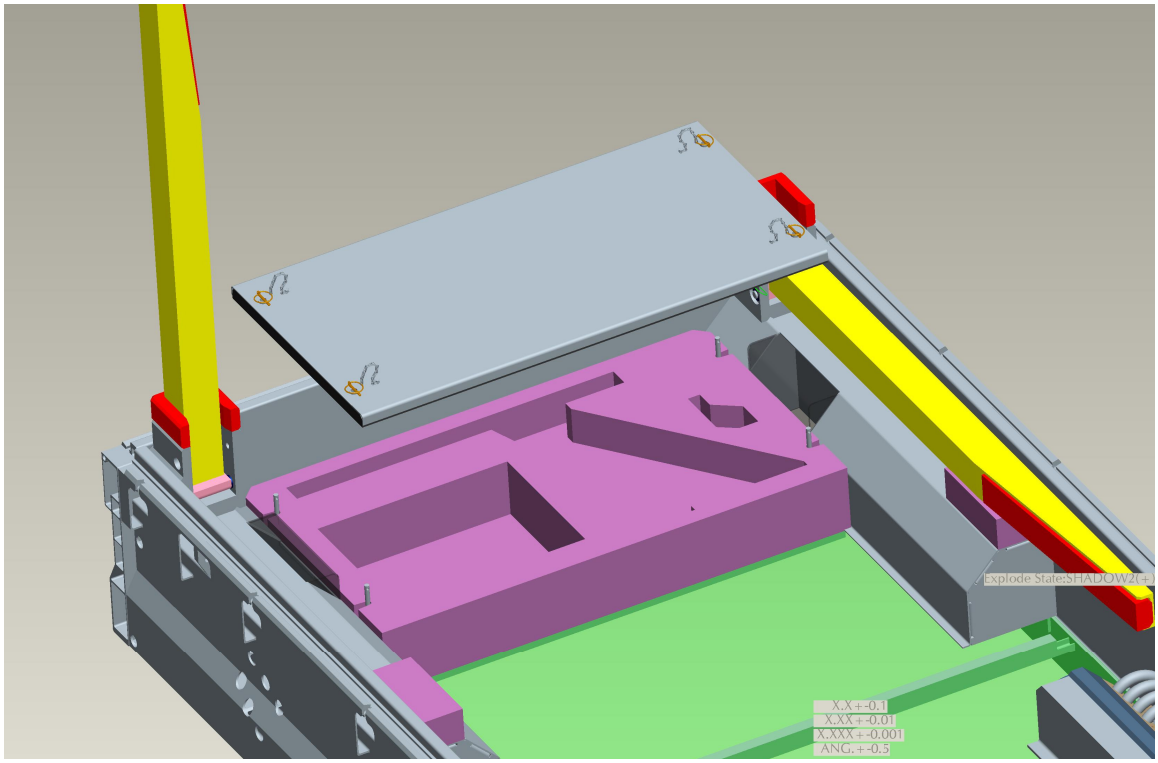


Figure 15. Fwd shadow box storage area with cover shown removed (CAD rendered).

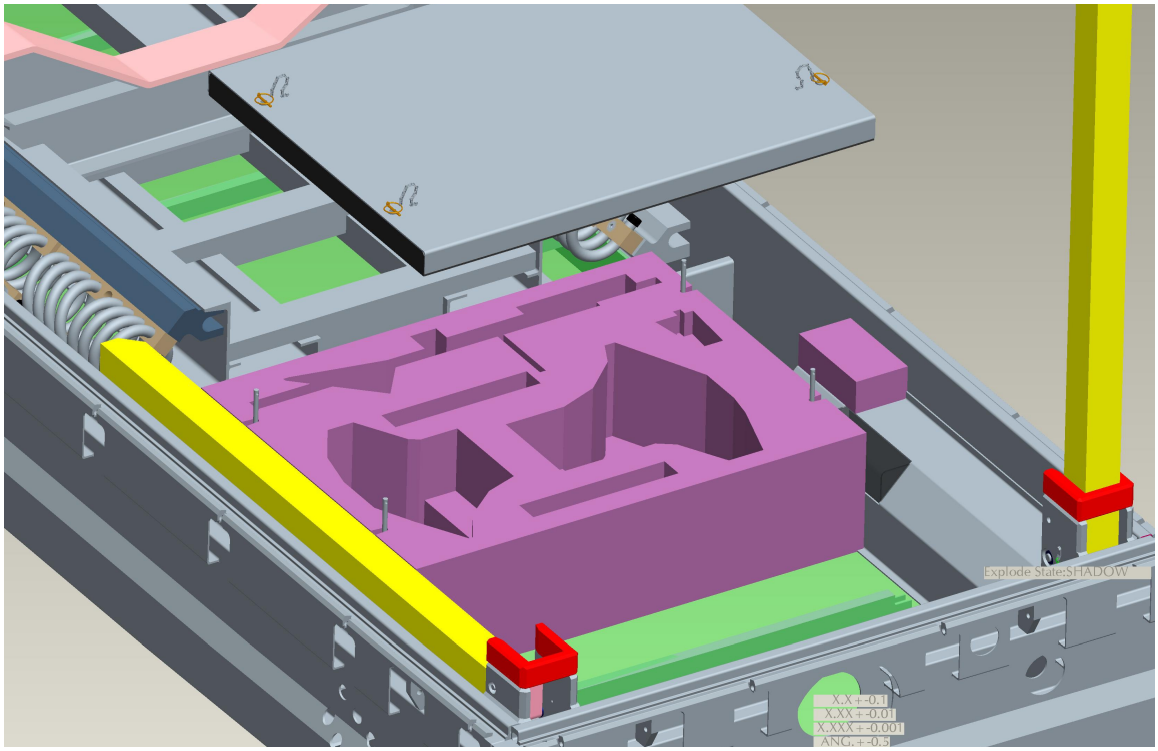


Figure 16. Aft shadow box storage area with cover shown removed (CAD rendered).

APPENDIX 3: Test Data

Table 1. MQ-9 Reaper Fuselage Impact Test Summary (filtered data)

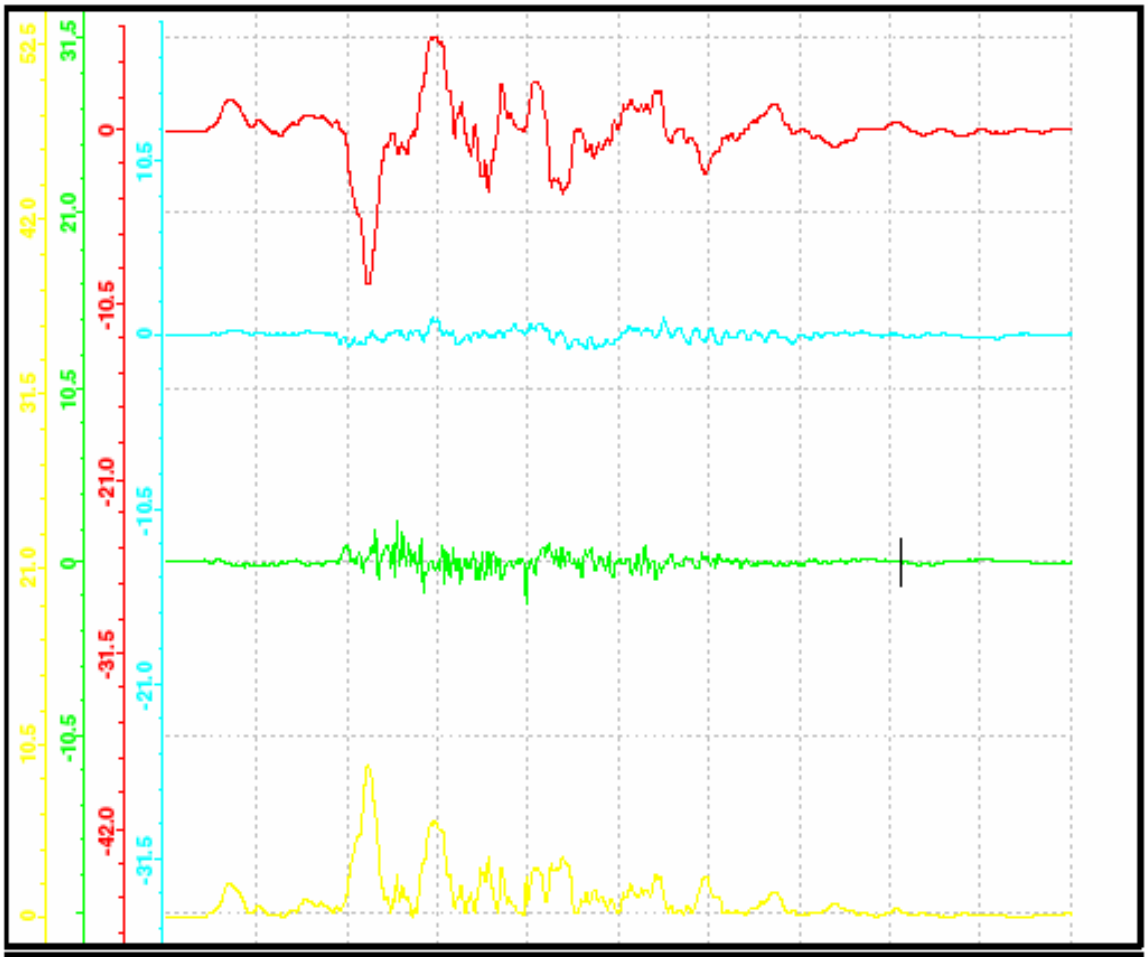
IMPACT TYPE	TEST TEMPERATURE	IMPACT LOCATION	RESULTANT PEAK G
ROTATIONAL - EDGE	ambient	forward-bottom	9
ROTATIONAL - EDGE	ambient	aft-bottom	9
ROTATIONAL - EDGE	ambient	left-bottom	6
ROTATIONAL - EDGE	ambient	right-bottom	6
ROTATIONAL - CORNER	ambient	forward-left	9
ROTATIONAL - CORNER	ambient	forward-right	9
ROTATIONAL - CORNER	ambient	aft-left	8
ROTATIONAL - CORNER	ambient	aft-right	7

REAPER FUSELAGE

ROTATIONAL DROP TEST

Time:	Aug 10 2007 7:57	Test Engineer:	Evans
Test Type:	Edge	Impact Point:	Forward edge
Container/Item:	Reaper Test Mass	Drop Height:	12 inches

V. Angle: 89.40; H.Angle: 354.89; Filter: - 70 Hz



Ch.	Time	Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
1	1.06 S	0.01 g's	1.11 g's	4.08 In/s	131 mS	1	2
2	1.06 S	0.52 g's	-9.24 g's	-2.58 In/s	131 mS	1	2
3	1.06 S	-0.05 g's	-3.46 g's	-2.19 In/s	131 mS	1	2
R	1.06 S	0.53 g's	9.25 g's	5.30 In/s	131 mS	1	2

Remarks

PEAK Gs X: 1 Y: 9 Z: 3 Peak Gs Resultant: 9. Filtered at 70 Hz.
Accelerometer on plate.
Ch.1=X(left-right); Ch.2=Y(vertical); Ch.3=Z(fwd-aft). Ch4=Resultant.

Aft Side = desiccant port end. Ambient temperature/humidity.
ASTM D4169, ASTM D6179. SAE ARP 1967. Accel. S/N 16473.

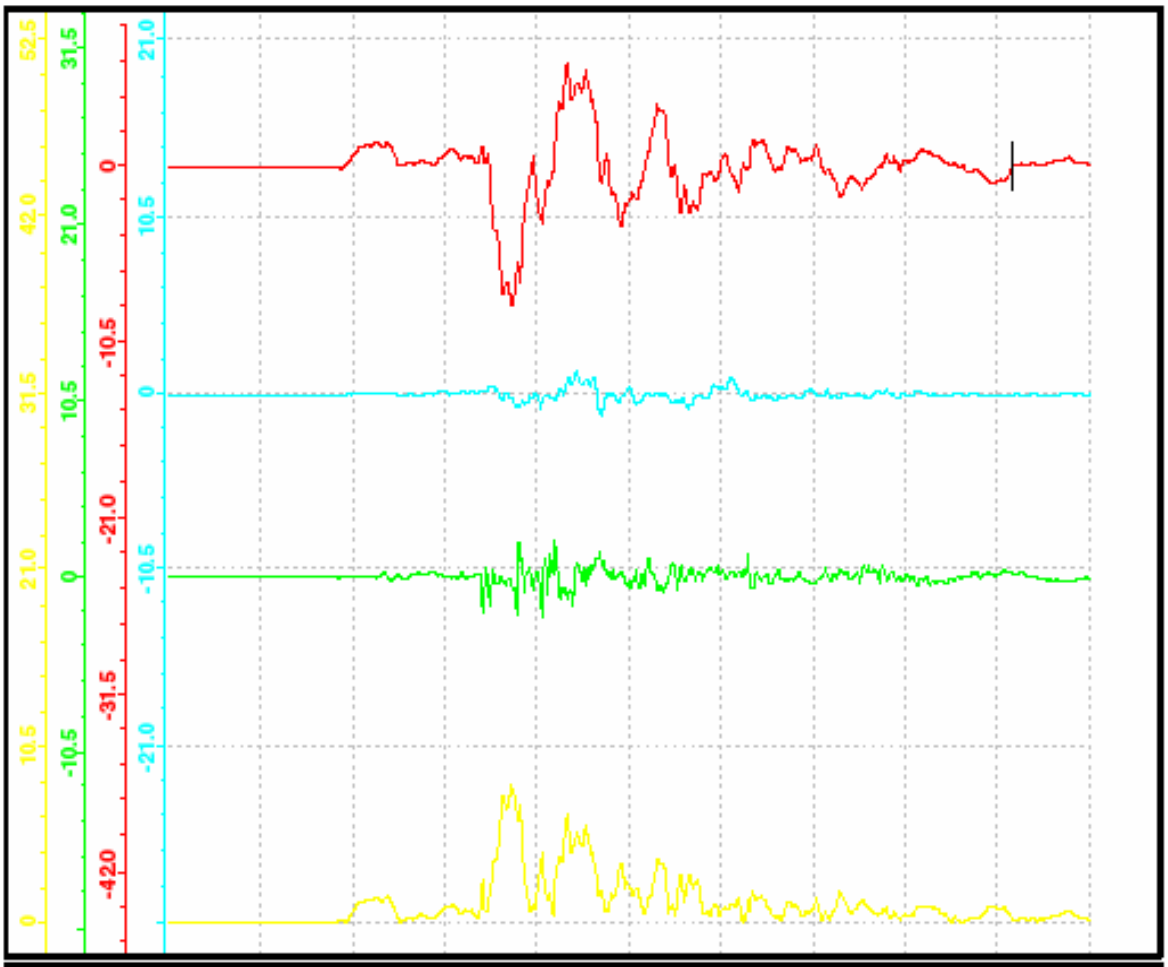
GHI SYSTEMS, INC. CAT SYSTEM

REAPER FUSELAGE

ROTATIONAL DROP TEST

Time:	Aug 9 2007 14:08	Test Engineer:	Evans
Test Type:	Edge	Impact Point:	Aft edge
Container/Item:	Reaper Test Mass	Drop Height:	12 inches

V. Angle: 87.34; H. Angle: 71.03; Filter: - 75 Hz



Ch.	Time	Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
1	1.20 S	0.01 g's	1.36 g's	-5.48 In/s	131 mS	1	2
2	744. mS	0.07 g's	-8.27 g's	-4.64 In/s	131 mS	1	2
3	1.20 S	0.21 g's	-5.95 g's	6.38 In/s	131 mS	1	2
R	1.20 S	0.22 g's	8.72 g's	9.60 In/s	131 mS	1	2

Remarks

PEAK Gs X: 2 Y: 8 Z: 6 Peak Gs Resultant: 9. Filtered at 75 Hz.
Accelerometer on plate.
Ch.1=X(left-right); Ch.2=Y(vertical); Ch.3=Z(fwd-aft). Ch4=Resultant.

Aft Side = desiccant port end. Ambient temperature/humidity.
ASTM D4169, ASTM D6179. SAE ARP 1967. Accel. S/N 16473.

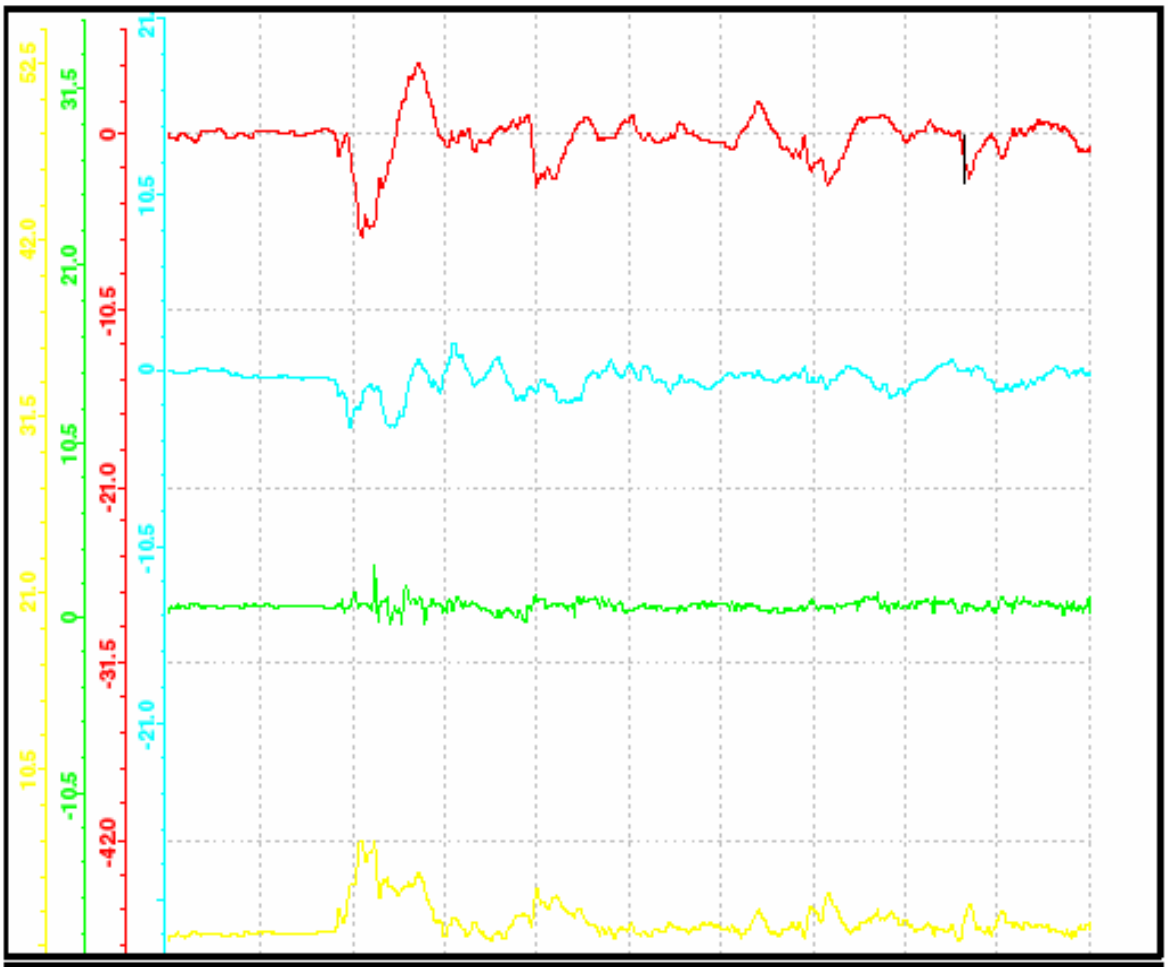
GHI SYSTEMS, INC. CAT SYSTEM

REAPER FUSELAGE

ROTATIONAL DROP TEST

Time:	Aug 10 2007 9:19	Test Engineer:	Evans
Test Type:	Edge	Impact Point:	Left edge
Container/Item:	Reaper Test Mass	Drop Height:	12 inches

V. Angle: 90.89; H.Angle: 150.55; Filter: - 80 Hz



Ch.	Time	Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
1	1.13 S	-0.03 g's	-3.49 g's	-244.06 In/s	131 mS	1	2
2	1.13 S	-1.48 g's	-5.98 g's	-58.07 In/s	131 mS	1	2
3	1.13 S	0.84 g's	3.17 g's	295.92 In/s	131 mS	1	2
R	1.13 S	1.70 g's	6.35 g's	387.96 In/s	131 mS	1	2

Remarks

PEAK Gs X: 3 Y: 6 Z: 3 Peak Gs Resultant: 6. Filtered at 80 Hz.
Accelerometer on plate.
Ch.1=X(left-right); Ch.2=Y(vertical); Ch.3=Z(fwd-aft). Ch4=Resultant.

Aft Side = desiccant port end. Ambient temperature/humidity.
ASTM D4169, ASTM D6179. SAE ARP 1967. Accel. S/N 16473.

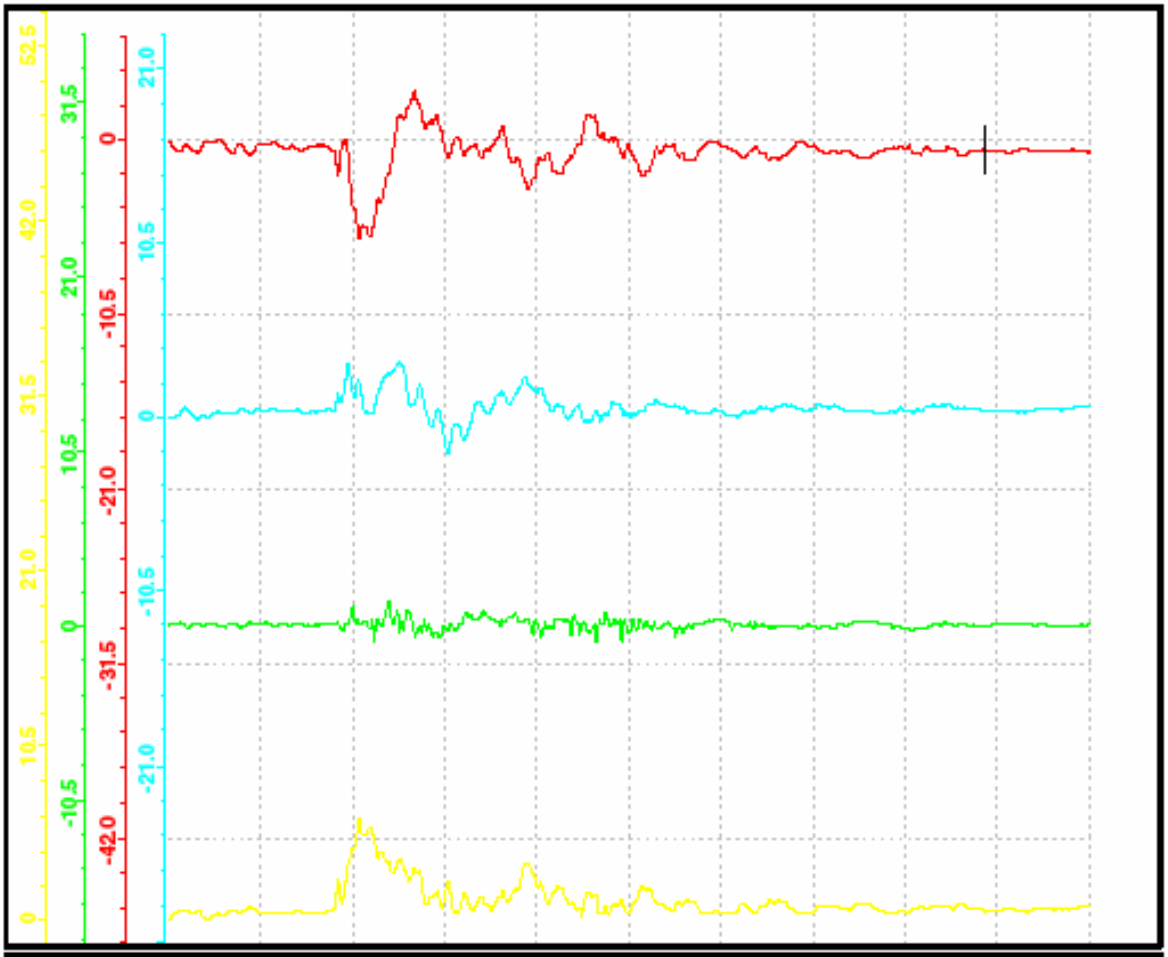
GHI SYSTEMS, INC. CAT SYSTEM

REAPER FUSELAGE

ROTATIONAL DROP TEST

Time:	Aug 10 2007 9:02	Test Engineer:	Evans
Test Type:	Edge	Impact Point:	Right edge
Container/Item:	Reaper Test Mass	Drop Height:	12 inches

V. Angle: 47.11; H. Angle: 180.12; Filter: - 80 Hz



Ch.	Time	Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
1	1.16 S	0.39 g's	3.36 g's	257.85 In/s	131 mS	1	2
2	1.16 S	-0.43 g's	-5.97 g's	-257.98 In/s	131 mS	1	2
3	1.16 S	-0.00 g's	1.69 g's	32.26 In/s	131 mS	1	2
R	1.16 S	0.58 g's	6.38 g's	366.17 In/s	131 mS	1	2

Remarks

PEAK Gs X: 3 Y: 6 Z: 2 Peak Gs Resultant: 6. Filtered at 80 Hz.
Accelerometer on plate.
Ch.1=X(left-right); Ch.2=Y(vertical); Ch.3=Z(fwd-aft). Ch4=Resultant.

Aft Side = desiccant port end. Ambient temperature/humidity.
ASTM D4169, ASTM D6179. SAE ARP 1967. Accel. S/N 16473.

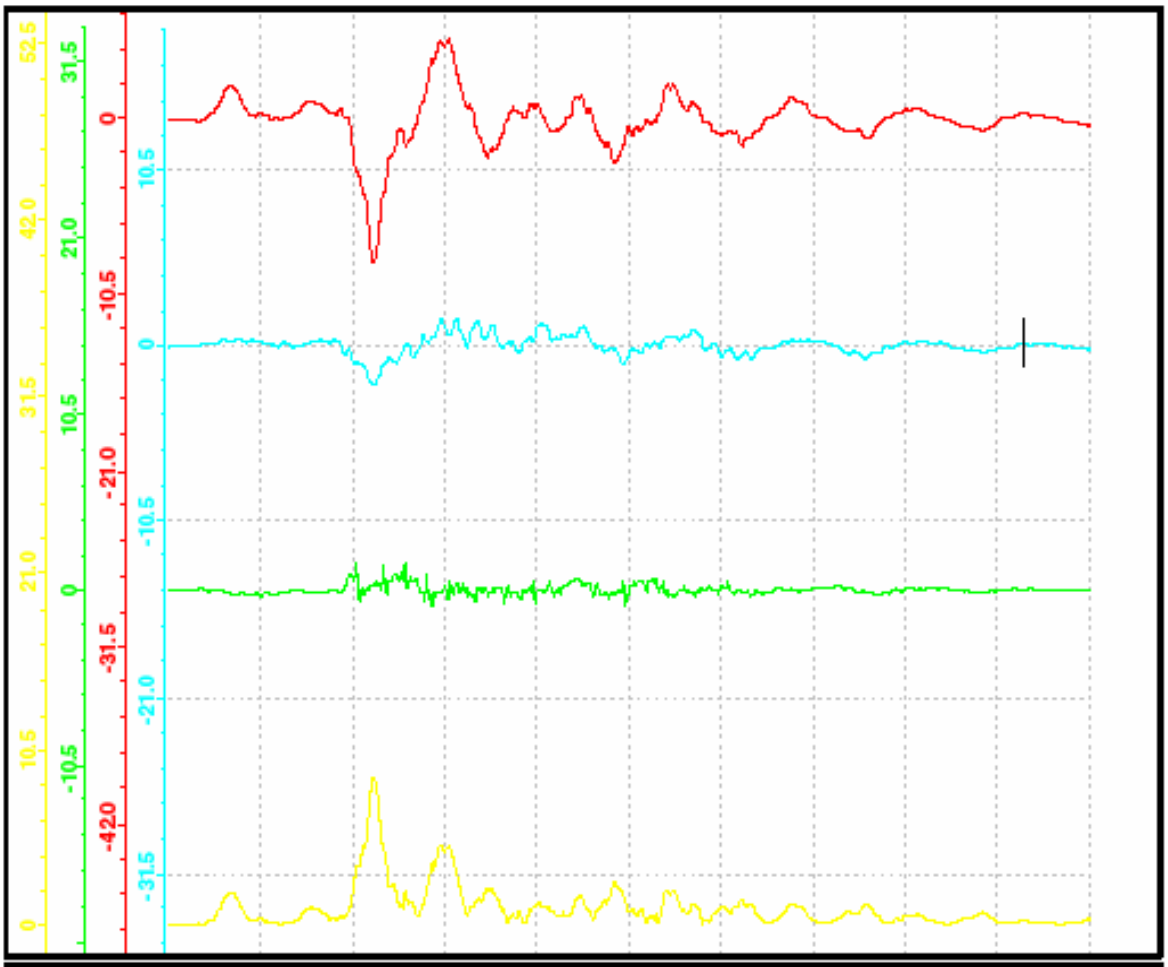
GHI SYSTEMS, INC. CAT SYSTEM

REAPER FUSELAGE

ROTATIONAL DROP TEST

Time:	Aug 10 2007 8:23	Test Engineer:	Evans
Test Type:	Corner	Impact Point:	Forward left corner
Container/Item:	Reaper Test Mass	Drop Height:	12 inches

V. Angle: 75.23; H.Angle: 6.16; Filter: - 70 Hz



Ch.	Time	Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
1	1.21 S	0.11 g's	-2.44 g's	-1.37 In/s	131 mS	1	2
2	1.21 S	0.41 g's	-8.56 g's	-21.62 In/s	131 mS	1	2
3	1.21 S	0.04 g's	-2.18 g's	17.87 In/s	131 mS	1	2
R	1.21 S	0.42 g's	8.90 g's	28.08 In/s	131 mS	1	2

Remarks

PEAK Gs X: 2 Y: 9 Z: 2 Peak Gs Resultant: 9. Filtered at 70 Hz.
Accelerometer on plate.
Ch.1=X(left-right); Ch.2=Y(vertical); Ch.3=Z(fwd-aft). Ch4=Resultant.

Aft Side = desiccant port end. Ambient temperature/humidity.
ASTM D4169, ASTM D6179. SAE ARP 1967. Accel. S/N 16473.

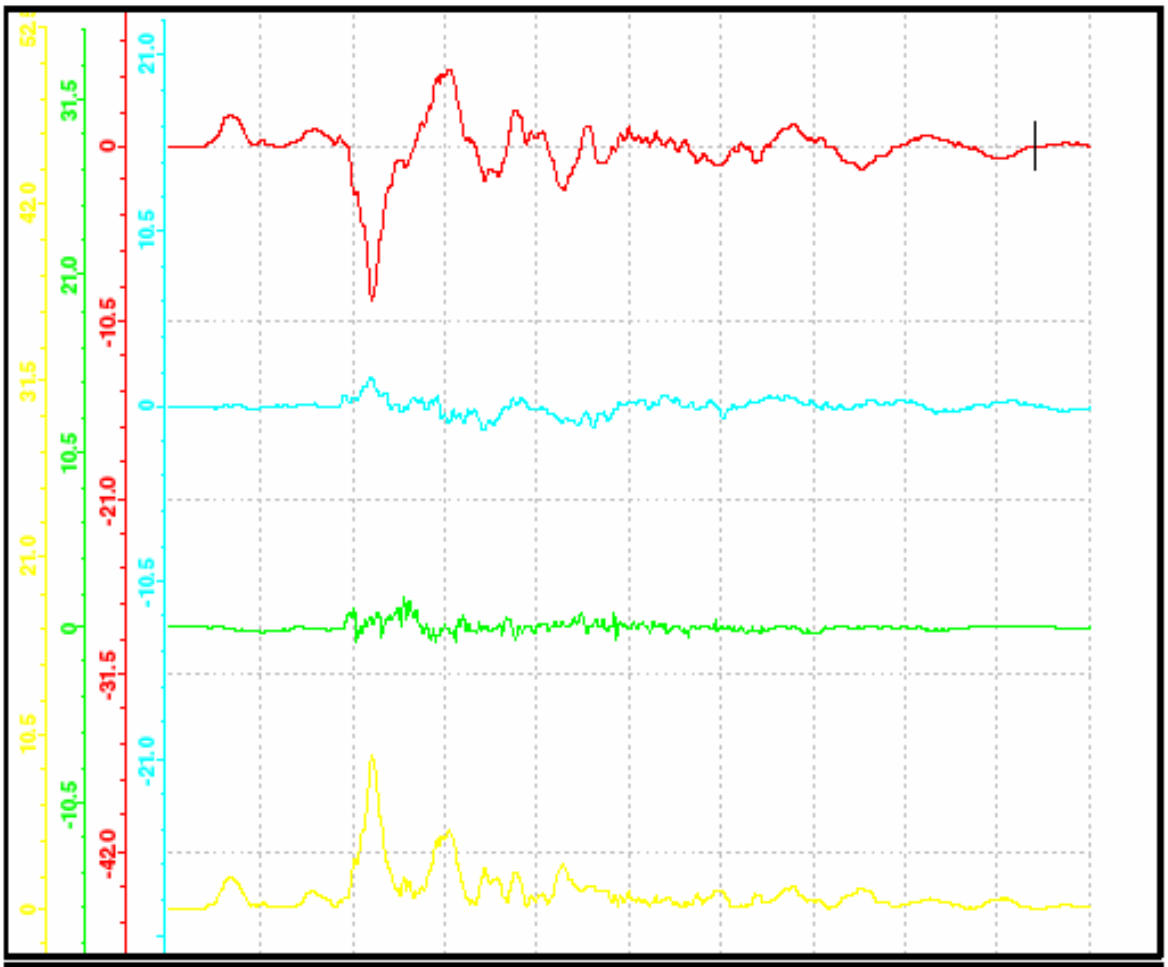
GHI SYSTEMS, INC. CAT SYSTEM

REAPER FUSELAGE

ROTATIONAL DROP TEST

Time:	Aug 10 2007 8:30	Test Engineer:	Evans
Test Type:	Corner	Impact Point:	Forward right corner
Container/Item:	Reaper Test Mass	Drop Height:	12 inches

V. Angle: 42.26; H.Angle: 22.43; Filter: - 70 Hz



Ch.	Time	Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
1	1.23 S	0.07 g's	1.81 g's	1.34 In/s	131 mS	1	2
2	1.23 S	0.06 g's	-9.10 g's	-24.99 In/s	131 mS	1	2
3	1.23 S	0.02 g's	2.08 g's	8.39 In/s	131 mS	1	2
R	1.22 S	0.09 g's	9.25 g's	26.40 In/s	131 mS	1	2

Remarks

PEAK Gs X: 2 Y: 9 Z: 2 Peak Gs Resultant: 9. Filtered at 70 Hz.
Accelerometer on plate.
Ch.1=X(left-right); Ch.2=Y(vertical); Ch.3=Z(fwd-aft). Ch4=Resultant.

Aft Side = desiccant port end. Ambient temperature/humidity.
ASTM D4169, ASTM D6179. SAE ARP 1967. Accel. S/N 16473.

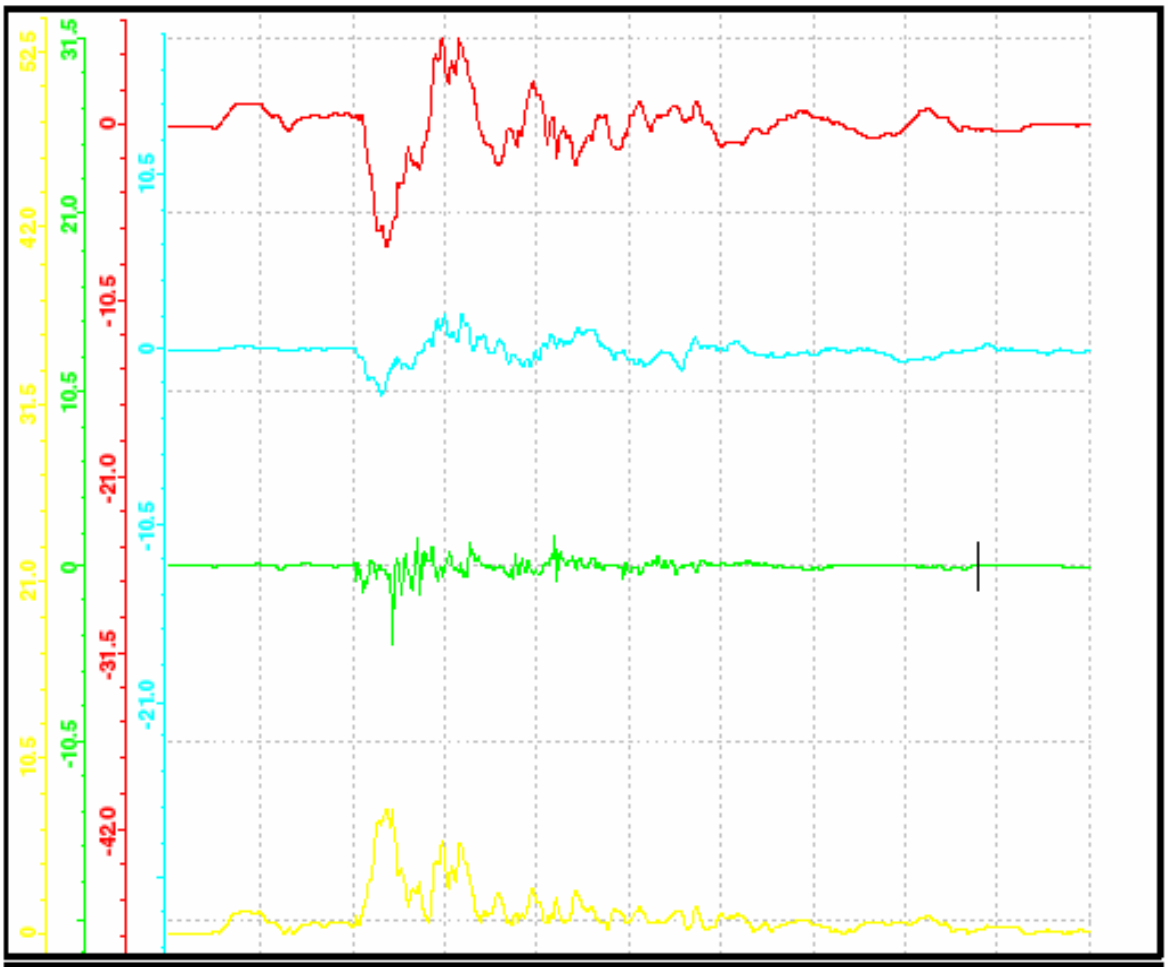
GHI SYSTEMS, INC. CAT SYSTEM

REAPER FUSELAGE

ROTATIONAL DROP TEST

Time:	Aug 10 2007 7:49	Test Engineer:	Evans
Test Type:	Corner	Impact Point:	Aft left corner
Container/Item:	Reaper Test Mass	Drop Height:	12 inches

V. Angle: 51.42; H. Angle: 178.62; Filter: - 70 Hz



Ch.	Time	Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
1	1.15 S	0.15 g's	-2.67 g's	-15.67 In/s	131 mS	1	2
2	1.15 S	-0.19 g's	-7.21 g's	-2.76 In/s	131 mS	1	2
3	1.15 S	0.00 g's	-4.53 g's	1.17 In/s	131 mS	1	2
R	1.14 S	0.24 g's	7.50 g's	15.96 In/s	131 mS	1	2

Remarks

PEAK Gs X: 3 Y: 7 Z: 5 Peak Gs Resultant: 8. Filtered at 70 Hz.
Accelerometer on plate.
Ch.1=X(left-right); Ch.2=Y(vertical); Ch.3=Z(fwd-aft). Ch4=Resultant.

Aft Side = desiccant port end. Ambient temperature/humidity.
ASTM D4169, ASTM D6179. SAE ARP 1967. Accel. S/N 16473.

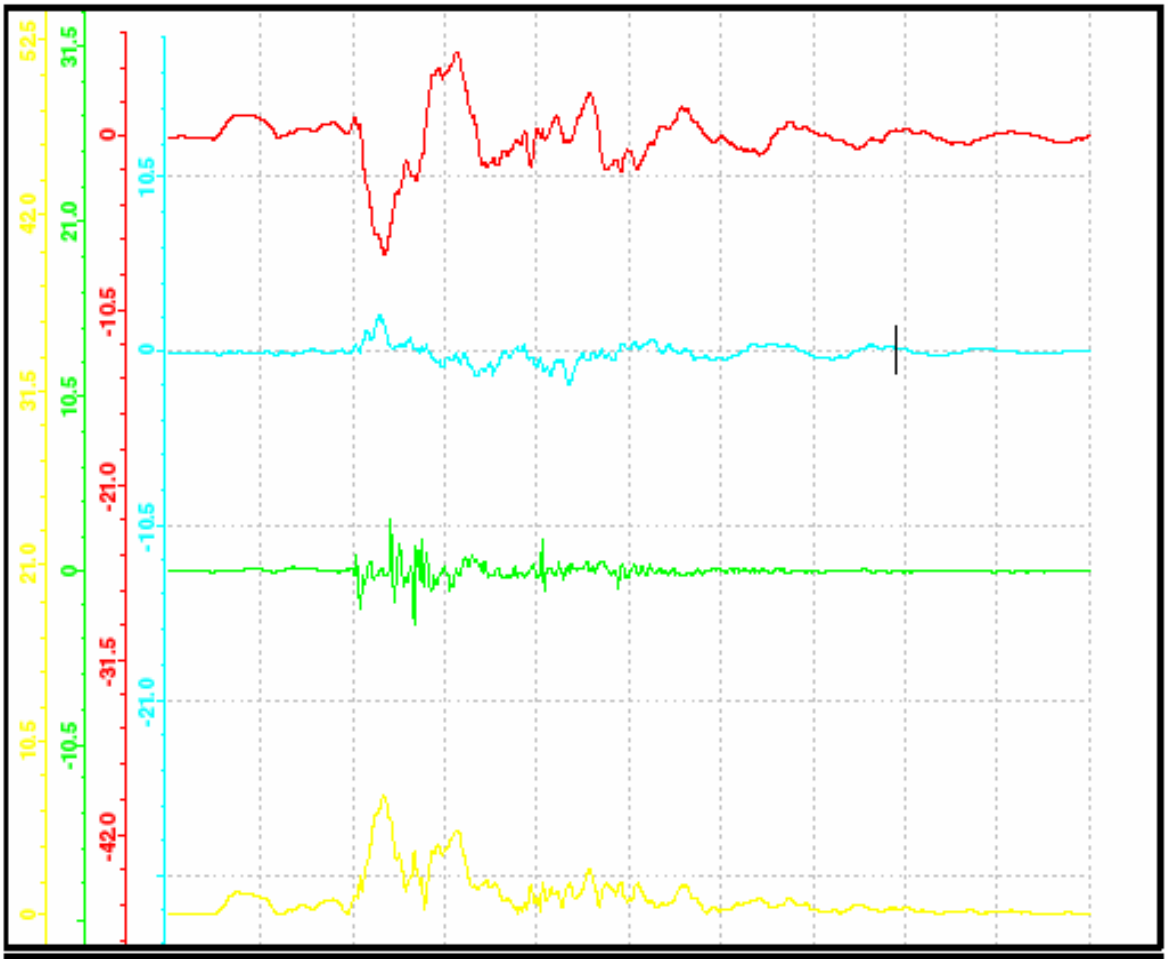
GHI SYSTEMS, INC. CAT SYSTEM

REAPER FUSELAGE

ROTATIONAL DROP TEST

Time:	Aug 9 2007 14:35	Test Engineer:	Evans
Test Type:	Corner	Impact Point:	Aft right corner
Container/Item:	Reaper Test Mass	Drop Height:	12 inches

V. Angle: 67.56; H. Angle: 1.94; Filter: - 70 Hz



Ch.	Time	Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
1	1.03 S	0.18 g's	2.15 g's	-11.25 In/s	131 mS	1	2
2	1.03 S	0.43 g's	-7.02 g's	12.11 In/s	131 mS	1	2
3	1.03 S	0.01 g's	-4.49 g's	-3.66 In/s	131 mS	1	2
R	1.03 S	0.47 g's	7.28 g's	16.93 In/s	131 mS	1	2

Remarks

PEAK Gs X: 2 Y: 7 Z: 4 Peak Gs Resultant: 7. Filtered at 70 Hz.
Accelerometer on plate.
Ch.1=X(left-right); Ch.2=Y(vertical); Ch.3=Z(fwd-aft). Ch4=Resultant.

Aft Side = desiccant port end. Ambient temperature/humidity.
ASTM D4169, ASTM D6179. SAE ARP 1967. Accel. S/N 16473.

GHI SYSTEMS, INC. CAT SYSTEM

APPENDIX 4: Test Instrumentation

PRESSURE TEST EQUIPMENT - Test sequences 1 & 2

EQUIPMENT	MANUFACTURER	MODEL	SN	CAL. DATE
Digital Manometer	Yokogawa	2655	82DJ6001	Jun 07
Digital Manometer	Yokogawa	2655	82DJ6009	Jul 07

ROUGH HANDLING TEST EQUIPMENT - Test sequence 3

EQUIPMENT	MANUFACTURER	MODEL	SN	CAL. DATE
Shock Amplifier	Endevco	2775A	ER34	NA
Shock Amplifier	Endevco	2775A	ER33	NA
Shock Amplifier	Endevco	2775A	EL81	NA
Item Accelerometer	Endevco	2228C	16473	Sep 06
Data Acquisition	GHI Systems	CAT	Ver. 2.7.1	N/A

APPENDIX 5: Distribution List

DISTRIBUTION LIST

DTIC/O
DEFENSE TECHNICAL INFORMATION CENTER
FORT BELVOIR VA 22060-6218

591 SCMG/CL
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403 SCMS/CL
WRIGHT-PATTERSON AFB OH 45433-5540

510 CBSS/GBMAD (ATTN: THELMA LOOCK)
7973 UTILITY DR.
BLDG. 1135
HILL AFB UT 84056

559 CBSS/GBLA (ATTN: JEAN BAXTER)
7701 ARNOLD ST.
BLDG. 1, RM 112
TINKER AFB OK 73145

586 CBSS/GBMCAA (ATTN: WAYNE OSBORN)
375 PERRY ST.
BLDG. 255
ROBINS AFB GA 31098

658 AESS/LG (ATTN: GERALD WILLIAMS)
2640 LOOP ROAD WEST
WRIGHT-PATTERSON AFB OH 45433-5540

GENERAL ATOMICS
ATTN: DAVID LEVY
16761 VIA DEL CAMPO CT
SAN DIEGO, CA 92127

APPENDIX 6: Report Documentation

REPORT DOCUMENTATION PAGE	*Form Approved OMB No. 0704-0188*

1. REPORT DATE *(DD-MM-YYYY)*	**2. REPORT TYPE**	**3. DATES COVERED** *(From - To)*
05-20-2008	Technical, Final Project Report	March 2006 – May 2008

4. TITLE AND SUBTITLE
Development of the MQ-9 Reaper Fuselage Container

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
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5d. PROJECT NUMBER
06-P-103

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Air Force Packaging Technology and Engineering Facility
403 SCMS/GUEB
5215 THURLOW ST, STE 5, BLDG 70C
WRIGHT-PATTERSON AFB OH 45433-5540

8. PERFORMING ORGANIZATION REPORT NUMBER
08-R-07

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

The Air Force Packaging Technology & Engineering Facility (AFPTEF) was tasked with the design of a new shipping and storage container for the MQ-9 Reaper fuselage in March of 2006. The previous container did not adequately satisfy user needs and Air Force requirements. A main problem was that it was designed for an MQ-9 Reaper fuselage, wings, and tails combined, which exceeded the 10,000 lb Air Force requirement for available ground support equipment. AFPTEF designed a smaller container for only the MQ-9 Fuselage and a separate container for the wings and tails in order to bring container weights down under the 10,000 lb upper limit. Both containers feature retractable casters for rapid C-130 deployment and easier handling. The MQ-9 Fuselage container features a wire rope isolator mounted cradle system to protect the fuselage (20G fragility), ballast storage areas, and shadow box storage areas for assorted small parts. The new container, designed with SAE ARP1967A, is an aluminum, long-life, controlled breathing, reusable shipping and storage container that protects the MQ-9 Reaper fuselage and has passed all tests.

15. SUBJECT TERMS
CNU-697/E, Predator, MQ-9, Fuselage Container, Aluminum Container, Reusable Container, Design, Test, Long-life

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
a. REPORT	**b. ABSTRACT**	**c. THIS PAGE**			Matthew P. Bozzuto
U	U	U	UU	33	**19b. TELEPHONE NUMBER** *(Include area code)* (937)257-7166

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